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CORRUPTION: THE TRUE CAUSE OF
THE RESOURCE CURSE?

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
Economics

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by
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Accepted by:
Michael Maloney, Committee Chair
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Robert Tollison

ABSTRACT

The theory of the Resource Curse suggests that countries with high levels of natural resources are actually found to possess lower gross domestic products. The source of this disparity is widely debated; however, this analysis suggests that the underlying force preventing such nations from taking advantage of their natural capital abundance is corruption within their economic and governmental systems. In addition, the resource quality is examined to see that it too affects the ability of a nation to change such assets into a higher overall level of national wealth.

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INTRODUCTION

In determining a nation's wealth, it would be reasonable to assume that the more natural resources a country possesses, the higher their gross domestic product (GDP) will be as a result of having more capital at their disposal. This, however, has proven in the past to not be the case. It has been found that there is actually an opposite effect, which has become known as the "resource curse." This theory suggests that countries with greater levels of natural resources will actually have lower GDP's than those without or with very little. Nigeria, for instance, has seen great declines in their per capita GDP in the past couple decades despite the fact that they have received several billion dollars in oil revenue. (Herringshaw, 2004)

There are, of course, exceptions to the theory. Over the course of the eighteenth and nineteenth centuries, iron and coal were the basis for industrialization. Having reserves of such materials was a way of enhancing a nation's industrial capabilities, which meant higher growth rates and greater GDP's. Additionally, during the twentieth century, resource rich countries like Iceland and Norway experienced substantial growth after finding and exploiting natural resources, mostly consisting of oil. (Gerlagh and Papyrakis, 2003) This is reason enough to believe that there is inefficient handling in the way the resources are garnered, distributed, traded, or sold, which is in turn leading to the curse. Because the presence of resources alone cannot cause a lack of economic growth, there has to be an underlying force, something driving the disparity.

The source of the phenomenon is widely debated. However, I will test that corruption among officials and politicians is the main driving force behind economic losses. It is their responsibility to enforce a rule of law and code of conduct in order to ensure a fair system is implemented. Without this, bribery and side payments, as well as other inefficient business practices become the norms for participating in everyday commerce. Any sort of rents that would otherwise be obtained from the extraction of resources are absorbed into pockets of dishonest bureaucrats, preventing the economy from reaping the benefits of its natural wealth.

I will examine the impact of corruption on the resource curse by determining if it is significant in a regression of variables known to affect a nation's wealth on GDP per capita. The Corruption Perception Index will be used as a measure of each country's corruption level. The effectiveness of each nation's government, which is determined by its commitment to policies and its credibility in creating a viable political structure, will be another variable representing the level of inefficiency or corruption in each country. (World Bank 2004) If these variables are in fact the cause for the resource curse, they should not only be significant in the regression, but change the coefficients on natural resources as well. If they hold no merit in determining a nation's GDP per capita the coefficients on each corruption measure can be expected to be statistically insignificant. I will use this as a guide for seeking out the true political and social inefficiencies causing a country with more capital to actually be in a worse economic situation.

LITERATURE SEARCH

A vast array of research has been done in order to better explain the phenomenon of the resource curse and its implications. Bulte, Damania, and Deacon (2005) examine another angle between resource abundance and the wealth of a nation by looking at various human welfare indictors as a substitute for GDP or economic growth. These variables include life expectancy, the percentage of the population that is undernourished, and the percentage of people without access to safe water. The data on resources are measured as a share of total exports in each country. Using this to determine a nation's natural resource level may have some significant discrepancies. It assumes the country is an active exporter and fails to acknowledge that countries may be stockpiling varied amounts of resources at any given time, which implies an obvious fault in the results. Taking this possible data complication into consideration, they do find evidence that a negative correlation exists between natural resource levels and human welfare indicators, consistent with theory.

A different aspect of the curse and its effects are examined by Collier and Hoeffler (2005). They test the link between natural resources and the number of civil wars within a country. This, which is also very much a curse, does in fact prove to be significant, as there is a connection between a nation's level of conflict and their possession of natural resources. They measure natural resources by determining the average rents or profits made on the sale of resources, calculated by subtracting the average cost of extraction from the average world price, and then multiplying this by each nation's level of extraction. This omits the uncertainty of a country's export volatility in determining the value of their resources and because of this, it is also the way I measure each nation's resource level.

Norway's economic acceleration beginning in the 1970's, as a consequence of their finding oil, led Larsen (2005) to examine whether rich countries are immune to the resource curse. He uses Norway's growth cycle as a guide and determines that while they did experience a period of hastened development, which finally caught up to their neighbors and soon surpassed them, they eventually hit a slowing point leading to the possibility of the onset of the resource curse. This, however, is not conclusive as it is fairly common for a nation to see an immediate boom with the addition of a new technology or source of capital and then slow back down to levels more comparable of a steady status. There may also have been other factors leading to their halt in growth, such as a lag in other industries.

THEORETICAL MODEL

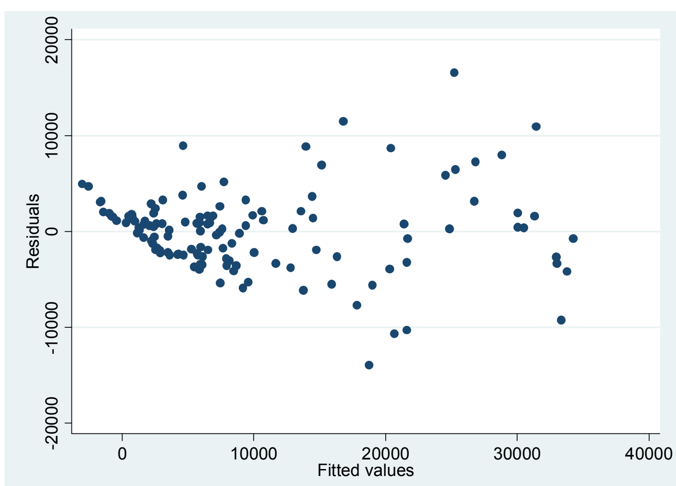
Due to the fact that corruption can lead to so many inefficiencies in the business process, I believe that it has the most significant impact in the ability of a nation to convert its natural resources into financial growth. I will, therefore, include this with other factors that influence a nation's GDP in testing the effects of each variable and their importance. The things that make up corruption will include the susceptibility of a country's political and public sector to participate in bribes, as well as the transparency of various bureaucratic institutions.

One factor affecting GDP used in the regression, besides corruption, is the level of education attained by the citizens of each nation. A higher quality of human capital, as measured by how educated employees are, leads to more innovation on the part of the worker, which turns into greater rents for the country. If a nation is not willing to invest in the education of its people, they will surely be succumbed to low wage, labor intensive jobs, that are characteristic of lesser developed countries. A country's ability to participate in quick and efficient trade is another important indicator of their overall GDP. If an infrastructure is present that allows for goods to easily flow and for people to capitalize on any possible gains from trade, this will surely affect the potential of a nation to enjoy higher levels of national income.

EMPIRICAL MODEL

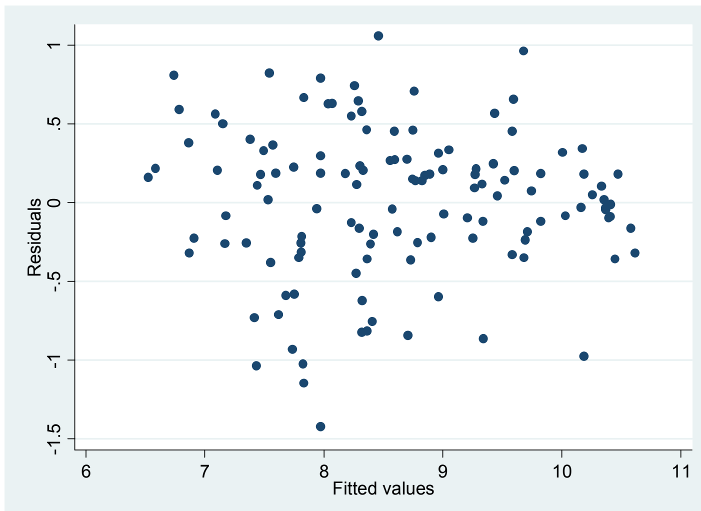
Each of the theoretical aspects is implemented into a mathematical regression formula to show the exact effects between the variables and a nation's GDP per capita. This model will also illustrate the significance of the variables and the strength of their relationship with per capita GDP. By testing several functional forms including log-log, linear, and linear-log, the most efficient in developing the model and explaining the data is log-linear. A graph of the residuals for the model in linear form, Figure 1, is a clear indication that there is a pattern, which is easily fixed by changing the dependent variable to log format.

Figure 1: Residuals of Linear Model



Transforming the regression to a log-linear form, not only corrects the misspecification error, but it is also much more conducive to the data, as the natural log of GDP per capita makes the distribution of the variable more narrow and limits the effect of any outliers. Figure 2 shows this plot.

Figure 2: Residuals of Log-Linear Model



The regression equation that will be used is:

$$\textbf{lngdpcap} = \beta_1 + \beta_2\textbf{cpiscore} + \beta_3\textbf{goveffectiveness} + \beta_4\textbf{literacy} + \beta_5\textbf{RoadPer100} + \beta_6\textbf{paved} + \beta_7\textbf{resource} + \textbf{e}$$

Here, **lngdpcap** is the natural log of the per capita GDP of each nation measured in dollars. **cpiscore** is the Corruptions Perceptions Index score that each country received. It is expected that the coefficient on this variable will be positive, as a higher score means less corruption and, therefore, a greater expected per capita GDP. Another variable encompassing corruption is **goveffectiveness**, which is the shown by a combination of quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies. More effective policymakers should ensure that rents from resources are being successfully distributed back into the economy and will, therefore, make this variable positive if in fact corruption decreases GDP.

Literacy represents the literacy rate of each country. Because it is an indicator of education levels, this is expected to be positive in building the wealth of a nation. Measures of infrastructure are given by **RoadPer100**, which is the kilometers of road per 100 people, and **paved**, which is the percent of these roads that are paved. A well developed infrastructure allows for an easier flow of goods and in turn, it is expected that these will have positive coefficients as well. **resource** is an indicator for a country's level of natural resources, and because of the theory of the "resource curse" we will expect the coefficient on this to be negative.

DATA

The data used in the regression is cross sectional, as each variable is recorded per country for a given year. The variable **lngdpcap** is the natural log of per capita GDP (purchasing power parity) and is measured for 155 countries in dollars, taken from 2005. The maximum value was 11.04**,** which was Luxembourg and the minimum value was from Malawi at 6.39. The changes in per capita GDP's are fairly steady, with no large gaps, making neither of these an outlier. **cpiscore** is measured for each country on a scale from 1 to 10, with 1 being the most corrupt and 10 being the least. Corruption is assessed through a number of data sources and country experts, including business leaders within their own country and outside it, who look at the frequency and size of bribes in both the political and public sectors and then give an evaluation. The scores used in this data set are from 2005 and have an average across the 159 countries of 4.07.

In order to determine whether the political environment in a nation is conducive to efficient practice, I use the variable **goveffectiveness.** This is observed for the year 2004. It is found using 352 variables drawn from 32 sources and 30 different organizations including, "surveys of individuals or domestic firms with first-hand knowledge of the governance situation in the country," as well as "perceptions of country analysts at the major multilateral development agencies", and "other data sources from NGOs and commercial risk rating agencies." (Worldbank 2004) The scale is a percentile rank from 1 to 100, with a mean of 49.37. The 20 most and least corrupt countries according to these variables are given in Table 1.

Table 1: Most and Least Corrupt Countries

Country	goveffectiveness	Country	cpiscore
Switzerland	99.5	Iceland	9.7
Singapore	99.5	New Zealand	9.6
Iceland	99	Finland	9.6
Denmark	98.6	Denmark	9.5
Luxembourg	98.1	Singapore	9.4
Finland	97.6	Sweden	9.2
New Zealand	97.1	Switzerland	9.1
Netherlands	96.6	Norway	8.9
Norway	96.2	Australia	8.8
Canada	95.7	Austria	8.7
Australia	95.2	United Kingdom	8.6
Sweden	94.7	Netherlands	8.6
United Kingdom	94.2	Luxembourg	8.5
United States	93.8	Canada	8.4
Austria	93.3	Hong Kong	8.3
Belgium	92.8	Germany	8.2
Hong Kong	92.3	United States	7.6
Ireland	91.3	France	7.5
France	90.4	Belgium	7.4
Germany	88.5	Ireland	7.4
:		:	
Tajikistan	12.5	Indonisia	2.2
Eritrea	12.5	Ethiopia	2.2
Paraguay	12	Cameroon	2.2
Angola	11.5	Azerbaijan	2.2
Congo	11.1	Kenya	2.1
Zimbabwe	10.6	Pakistan	2.1
Burundi	9.1	Paraguay	2.1
Afghanistan	9.1	Somalia	2.1
Sudan	8.2	Sudan	2.1
Chad	7.7	Tajikistan	2.1
Cote D'Ivoire	7.2	Congo, Dem. Rep.	2.1
Sierra Leone	6.3	Angola	2
Turkmenistan	5.3	Cote D'Ivoire	1.9
Equatorial Guinea	4.8	Equatorial Guinea	1.9
Congo, Dem. Rep.	4.3	Nigeria	1.9
Iraq	3.4	Turkmenistan	1.8
Myanmar	2.9	Myanmar	1.8
Liberia	1	Haiti	1.8
Haiti	0.5	Bangladesh	1.7
Somalia	0	Chad	1.7

Literacy is measured as the percentage of the population over the age of 15 who can read and write. The data is gathered from the year 2003 and ranges from Niger at 17.6% to 100%, which includes Finland, Luxembourg, and Norway. It is evident from the average of 82.63% that Niger lays far outside the norms for most countries. In fact, almost every country under the 50% mark is in an African or Middle Eastern nation.

The kilometers of roadway in a nation and the percent of roads that are paved are indicators of the eminence of each country's infrastructure. **RoadPer100** is measured as the kilometers of total roads per 100 people and **paved** is the percentage of those roads that are paved. While it may seem that there would be a high correlation between the two variables, because they both deal with roadways, the correlation matrix in Table 2 shows that they are actually not that closely related. **RoadPer100** shows how easy it is to access the roads, based on the number of people using them, and will in turn indicate their convenience and ease of use in transporting goods. Therefore, along with **paved**, these will provide two useful measures, one representing quality and the other quantity of each nation's infrastructure.

Table 2: Correlation Matrix (RoadPer100, Paved)

	Road~100	paved
RoadPer100	1.0000	
paved	0.2360	1.0000

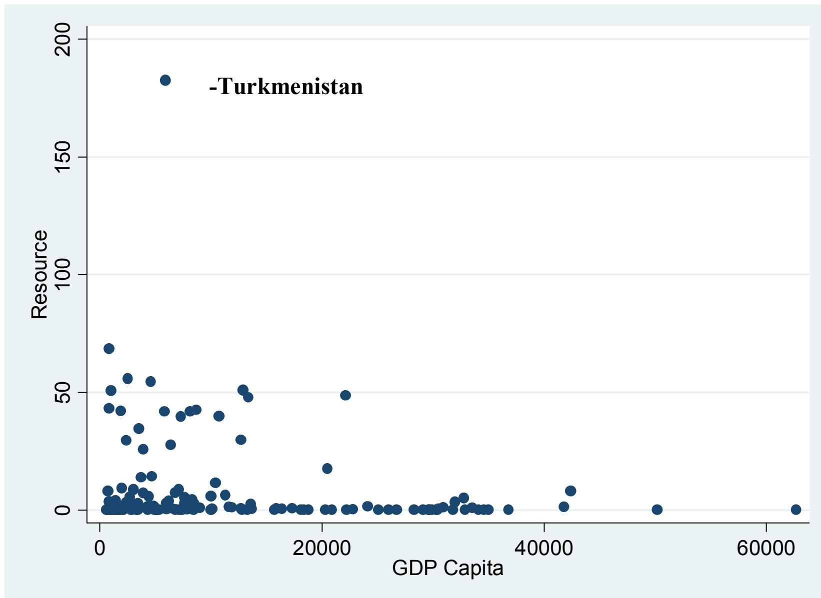
In order to measure natural resources, I use the variable **resource.** This includes energy based (coal, crude oil, and natural gas) and mineral based (tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate) resources. It is calculated using the following formula:

$$\textbf{production volume * average market price * } \frac{\textbf{(unit world price-average cost)}}{\textbf{unit world price}}$$

This essentially takes the world price per unit of each resource, subtracts the average cost of extraction and divides by the world price to determine the ratio of rents that should be received from the sale of a unit of each resource. This is then multiplied by the world price, as well as the production volume in each country, to determine total rents from the resources. Quantities and prices are found through multiple sources including the Organization of Economic Cooperation and Development, British Petroleum, International Energy Agency, International Petroleum Encyclopedia, national sources, United Nations, World Bank, and the Mineral Yearbook (2005).

The values are then computed as a percent of the nation's Gross National Income. They are recorded for the year 2000; however, updates have been made through 2003. The maximum is 182.7, which is from Turkmenistan. They may be one of the best examples of corruption's effect on the resource curse, as they have a CPI score of only 1.8 and their per capita GDP is a mere $5900. This makes it apparent, at least in their case that higher corruption does coincide with lower GDP's. A graph of resources against GDP per capita is shown by Figure 3.

Figure 3: Resources, GDP Per Capita



It indicates that there is a negative relationship between resource rents and each nation's GDP. Due to the fact that there are a fairly large amount of nations who produce no natural resources at all, there are a reasonable number of zero's in the data for this variable, which is also shown by the graph. Turkmenistan is an evident outlier; however, it has no significant effect on the regression when it is dropped, versus when it remains in the data. Therefore, it will continue to be included in the figures and model.

Table 3 provides all statistics for each variable used in the model in greater detail.

Table 3: Data Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
lngdpcapita	155	8.697624	1.191567	6.39693	11.04612
resource	149	8.187248	20.50371	0	182.7
cpiscore	159	4.077987	2.178481	1.7	9.7
goveffecti~s	158	49.37722	29.21709	0	99.5
literacy	156	82.63333	19.80649	17.6	100
RoadPer100	157	7.384306	8.949911	.2638329	47.13631
paved	134	50.29701	33.88296	.8	100

There are some possible implications with the data that should be recognized. The variables **cpiscore** and **goveffectiveness** run the risk of measurement error, as they are both based on non-concrete valuation techniques. Their measures are determined by people's perceptions, which can be rather ambiguous. While there are many factors that go into making sure each is highly accurate, there is still some possibility for error.

I do, however, believe that the formula being used to measure resource levels will have some positive effects on the results as it accounts for actual extraction levels, the monetary value of the commodity, and its cost for extraction. By not using resources as a percent of exports, like many studies do, there leaves no discrepancy between countries whose policies limit trade, or those who simply choose to keep most of their product domestic.

ANALYSIS

The first regression run does not include the corruption variables, **cpiscore** and **goveffectiveness,** in order to provide a means of comparison when they are later added. Table 4 gives the results of this regression. All variables are significant and have the expected sign except **resource,** which is negative as predicted, but insignificant.

Table 4: Corruption Omitted

Source	SS	df	MS
Model	107.559951	4	26.8899877
Residual	58.4638151	122	.479211599
Total	166.023766	126	1.31764894

Number of obs	127
F(4, 122)	56.11
Prob > F	0.0000
R-squared	0.6479
Adj R-squared	0.6363
Root MSE	.69225

lngdpcapita	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
resource	-.0024059	.0028256	-0.85	0.396	-.0079993	.0031876
literacy	.0207023	.0041305	5.01	0.000	.0125255	.0288791
RoadPer100	.0390945	.0079991	4.89	0.000	.0232595	.0549296
paved	.0123317	.0022357	5.52	0.000	.0079059	.0167574
_cons	6.030403	.2789382	21.62	0.000	5.478217	6.582589

Because heteroskedasticity or rather, the presence of a non-constant variance can alter standard errors, this could be causing **resource** to be insignificant. Therefore, the Breusch-Pagan test is run and it achieves the following results:

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
chi2(1) = 3.17
Prob > chi2 = 0.0748

This indicates that the null hypothesis should be rejected in favor of heterokedasticity. In order to correct this I use weighted least squares, which creates a constant variance by accounting for the discrepancies in observations and weighing those with high variances less. The dependent variable being per capita provides some insight about the distribution of the variance and, therefore, I use country population as a weight. This regression is shown in Table 5. In addition, it is run with robust standard errors.

Table 5: Corrected Heteroskedasticity-Corruption Omitted

```
                                                       Number of obs =     127
                                                        F(  4,   122) =   61.56
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.7754
                                                        Root MSE      =  .50936

------------------------------------------------------------------------------
             |               Robust
 lngdpcapita |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    resource |  -.0088773    .005286    -1.68   0.096    -.0193415    .0015869
    literacy |   .0249765   .0034893     7.16   0.000     .0180692    .0318839
  RoadPer100 |   .0673569   .0130762     5.15   0.000     .0414713    .0932425
       paved |   .0100321   .0022649     4.43   0.000     .0055486    .0145157
       _cons |   5.870775    .228855    25.65   0.000     5.417734    6.323817
------------------------------------------------------------------------------
```

By correcting for heteroskedasticity, all variables are now statistically significant at the 10 percent level. **Literacy**, **RoadPer100**, and **paved** all have the forecasted signs and indicate that increasing the percent of a country's population over 15 that can read and write by one, will raise GDP per capita by an average 2.4%, holding all other variables constant. **RoadPer100** has a fairly large coefficient revealing that when all else is held constant, increasing roadways by one kilometer per 100 people in the nation's population, will raise per capita GDP by 6.7% on average. **Resource** is now significant at the 10 percent level and has the expected negative sign showing that raising the percent of national income that comes from resource rents by one, will decrease GDP per capita by an average .8%. This seems small considering that to increase the share of a nation's income coming from resource rents by even one percent would require significantly more resources; therefore, one would think that the curse would have a greater effect on GDP.. Table 6 includes the corruption variable **cpiscore** and **goveffectiveness** to determine their effect on GDP and the curse.

Table 6: Corrected Heteroskedasticity-Corruption Included

```
                                                  Number of obs =     127
                                                  F(  6,   120) =   58.10
                                                  Prob > F      =  0.0000
                                                  R-squared     =  0.8544
                                                  Root MSE      =  .41352

------------------------------------------------------------------------------
             |               Robust
 lngdpcapita |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    resource |   .0021003     .005187     0.40   0.686    -.0081696    .0123702
    cpiscore |    .144168    .0490725     2.94   0.004     .0470077    .2413282
goveffecti~s |    .014234    .0041438     3.44   0.001     .0060296    .0224384
    literacy |   .0187555    .0032385     5.79   0.000     .0123435    .0251674
  RoadPer100 |   .0282861    .0118166     2.39   0.018       .00489    .0516823
       paved |    .003892    .0020721     1.88   0.063    -.0002106    .0079946
       _cons |     5.5503    .2435856    22.79   0.000     5.068017    6.032582
------------------------------------------------------------------------------
```

By adding **cpiscore** and **goveffectiveness**, we can now examine the impact of corruption on per capita GDP, as well as its significance in the resource curse theory. In this model, **literacy** still has a positive coefficient. However, it is smaller, as are the coefficients on **RoadPer100** and **paved**. Because leaving out variables creates bias, which in this case is upward, there was more weight given to the variables before the corruption factors were added, over inflating their values in the regression with the omitted variables. Each of these variables continues to remain significant. **Literacy** is still significant at the 1% level, while the infrastructure variables are now significant only at the 5% level. **Cpiscore** and **govefectiveness**, both have the forecasted signs indicating that a nation who increases government effectiveness by one percent will raise their per capita GDP by 1.2%, holding all other variables constant and that increasing a country's CPI score by one point will on average raise their GDP per capita by 15%.

What is most interesting about this regression, however, is the change in the coefficient on natural resources. Not only is it now insignificant, but it has a positive sign, as well. This suggests that corruption is a considerable factor when looking at the resource curse and when accounted for, it may even cause an opposite effect than the theory suggests. That is, holding corruption variables constant, increasing **resource** may increase a country's per capita GDP. Before corruption was taken into account, the resource curse seemed to be present, but once they are added into the regression **resource** loses all significance.

Table 7 gives a correlation matrix between the corruption variables and natural resources, showing that there is in fact a negative relationship between them. When a country has a high level of government effectiveness and greater CPI score, indicating less corruption, they have a lower amount of natural resources. This could, therefore, illustrate that natural resources actually promote corruption and will be further examined in later sections.

Table 7: Correlation Matrix (Cpiscore, Goveffectiveness, Resource)

	cpiscore	goveffectiveness	resource
cpiscore	1.0000		
goveffectiveness	0.8909	1.0000	
resource	-0.2130	-0.2563	1.0000

The corruption indices added another element to the model, which was better at explaining GDP per capita than some of the other variables, and caused a significant alteration in the results. The correlation matrix between **cpiscore** and **gdpcapita** in Table 8 gives even more evidence that if a nation is to fully capitalize on its resources, whether they are natural or human, what matters is effective and efficient policy. At .833, the two come very close to a correlation of one, which indicates a very close relationship.

Table 8: Correlation Matrix (Gdpcapita, Cpiscore)

	gdpcap~a	cpiscore
gdpcapita	1.0000	
cpiscore	0.8333	1.0000

Overall, this regression has a fairly high R^2 meaning that the variables provide a good explanation for the amount of change in GDP per capita fluctuations. Its value does, however, suggest that there are undoubtedly other factors accounting for GDP growth. The value of the F-Test for the parameters has a high value as well, clarifying that all variables together hold an especially high level of significance. The R-squared along with the F-Test figures are given in Table 9 below:

Table 9: R-Squared and F-Test Statistics

Number of obs =	127
F(6, 120) =	58.10
Prob > F =	0.0000
R-squared =	0.8544

DATA ALTERATIONS

In order to further solidify these results, some alternative variables have been tested in the regression. Rather than using **Roadper100** as a measure for the infrastructure, which again is the kilometers of roadways per 100 people in a country, **rdpersqkil** is entered in its place. This variable differs in that it accounts for infrastructure by computing the ratio of kilometers of roadways to square kilometers of land area for each nation. The comparison of results between each of the variables is given in Table 10. In all of the regressions, the endogenous variable being regressed upon remains **lngdpcapita.** The t-stats are shown in parenthesis below the coefficient, with an asterisk representing significance at least the 10% level.

Table 10: Comparing Infrastructure Measures

Resource	-0.0088	-0.0107	0.0021	0.0021
	(-1.68)*	(-1.69)*	(0.4)	(0.4)
Cpiscore			0.1441	0.2225
			(2.94)*	(3.16)*
Goveffeciveness			0.0142	0.0134
			(3.44)*	(2.69)*
Literacy	0.0249	0.0371	0.0187	0.0199
	(7.16)*	(7.16)*	(5.79)*	(7.06)*
Paved	0.01	0.008	0.0038	0.0032
	(4.43)*	(2.74)*	(1.88)*	(1.38)
Roadper100	0.0673		0.0282	
	(5.15)*		(2.39)*	
Rdpersqkil		0.2741		-0.0096
		(3.25)*		(-0.1)
Constant	5.8707	5.2345	5.5503	5.4119
	(25.65)*	(19.04)*	(22.79)*	(23.96)*

From this analysis, it is apparent that the difference in ratios between roadways per population and roadways per land area does not make a great enough impact on the results to change the variable or alter any conclusions about previous results. The coefficients on **resource** and the corruption variables are almost identical between the two, as is there significance level. For this reason, **Roadper100** will continue to be used in further analysis.

Another possible data specification error that should be taken into account is the gross domestic product (GDP) versus gross national income (GNI) differential embedded into the resource variable. Again, **resource** is found using the formula

$$\textbf{production volume * average market price *} \frac{\textbf{(unit world price-average cost)}}{\textbf{unit world price}}$$

This value is then taken as a percent of each country's GNI and regressed on the nation's per capita GDP, which seems contradictory. To correct for this, a new variable **resourcegdp** has been created by taking each nation's resource value, multiplying it by their GNI in 2000, which is when the resource data was compiled, and then dividing by their 2000 GDP. This changes **resource** from being a percent of GNI to a percent of GDP. The comparison of the two regressions is given in the table below:

Table 11: Resource Gross Domestic Product

Resource	0.0021	
	(0.4)	
resourcegdp		0.0038
		(0.73)
Cpiscore	0.1441	0.1458
	(2.94)*	(2.99)*
goveffeciveness	0.0142	0.0147
	(3.44)*	(3.51)*
Literacy	0.0187	0.0184
	(5.79)*	(5.77)*
Paved	0.0038	0.0036
	(1.88)*	(1.75)*
Roadper100	0.0282	0.0282
	(2.39)*	(2.36)*
Constant	5.5503	5.551
	(22.79)*	(22.67)*

These variables are again regressed up **lngdpcapita** and it is evident that there is no significant difference in the coefficients between the two. Therefore, while this variable may again be considered in future regressions, it does not appear that the GDP versus GNI differential is something that merits a lot of concern.

ADDITIONAL ANALYSIS

The idea that there could actually be a positive relationship between a country's resource level and its GDP needs some more examination. Different resources possess a wide variety of values and potential revenues for countries. For this reason, it is important to observe how certain assets affect a nation's income when they are broken down. The variable **resource** has, therefore, been divided up into two different sects as previously mentioned. One of which is **energy** and includes coal, crude oil, and natural gas, while the other, **mineral**, includes tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. Table 12 and 13 show how this breakdown of **resource** affects the regressions, both with and without the corruption variables.

Table 12: Resource Broken Down Without Corruption

Number of obs	127
F(5, 121)	53.02
Prob > F	0.0000
R-squared	0.7765
Root MSE	.51021

lngdpcapita	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
energy	-.0088649	.0053766	-1.65	0.102	-.0195093	.0017794
mineral	-.0608604	.0771357	-0.79	0.432	-.2135709	.0918501
literacy	.0252294	.0033934	7.43	0.000	.0185112	.0319476
RoadPer100	.0668666	.0125634	5.32	0.000	.0419941	.0917392
paved	.0098103	.0023411	4.19	0.000	.0051755	.0144451
_cons	5.882252	.2281134	25.79	0.000	5.430642	6.333863

Table 13: Resource Broken Down With Corruption

Number of obs	127
F(6, 120)	56.02
Prob > F	0.0000
R-squared	0.8566
Root MSE	.41218

lngdpcapita	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
energy	.0022873	.0052943	0.43	0.667	-.008196	.0127706
mineral	-.0712347	.0528851	-1.35	0.181	-.1759525	.0334831
cpiscore	.1367249	.0473166	2.89	0.005	.0430334	.2304165
goveffecti~s	.0149483	.0040542	3.69	0.000	.0069205	.022976
literacy	.0190931	.0031372	6.09	0.000	.0128812	.025305
RoadPer100	.0281801	.0114025	2.47	0.015	.005602	.0507582
paved	.0034915	.0021488	1.62	0.107	-.0007634	.0077463
_cons	5.558716	.2379214	23.36	0.000	5.087608	6.029824

By breaking up the resource variable, there has been a decrease in the level of significance on these coefficients. Therefore, addressing the regression in this way appears to be inefficient in analyzing the effect of different types of resources on a nation’s domestic product, as it provides no additional meaningful insight. Another approach, however, can be taken by valuing each type of resource (mineral and energy) as a percent of the individual country’s total resource level, rather than each type in terms of an absolute value.

For this, the amount of mineral based resources in the nation is divided by the country’s total national resource extraction and is represented by the variable **permineral**. The same is done for energy and will be given by **perenergy**. In Table 6, which was the original regression that included the corruption variables, **resource** is insignificant. Using each type of resource calculated as a percent of a nation’s total level will provide a proxy for the quality, based on price value, of resources in each country. Due to the fact that energy based resources have a higher monetary value, nations with a large percent of these materials will possess a high quality resource base. The two variables, **permineral** and **perenergy**, are run separately along with the variable **resource** for this regression to see if accounting for the nation's quality of resources affects its significance in impacting per capita GDP. The results are given in Table 14 and also include the regressions with the variable **resourcegdp** in place of **resource**.

Table 14: Mineral and Energy as a Percent of Total Resources

Permineral	-0.4566		-0.4431	
	(-2.32)*		(-2.22)*	
Perenergy		0.4566		0.4431
		(2.32)*		(2.22)*
Resource	-0.0024	-0.0024		
	(-0.43)	(-0.43)		
Resourcegdp			-0.0007	-0.0007
			(-0.12)	(-0.12)
Cpiscore	0.1592	0.1592	0.1586	0.1586
	(2.79)*	(2.79)*	(2.76)*	(2.76)*
goveffeciveness	0.0124	0.0124	0.0132	0.0132
	(2.73)*	(2.73)*	(2.82)*	(2.82)*
Literacy	0.0203	0.0203	0.0199	0.0199
	(5.78)*	(5.78)*	(5.72)*	(5.72)*
Paved	0.0016	0.0016	0.0014	0.0014
	(0.76)	(0.76)	(0.65)	(0.65)
Roadper100	0.0246	0.0246	0.0249	0.0249
	(2.34)*	(2.34)*	(2.32)*	(2.32)*
Constant	5.7449	5.7449	5.2892	5.2892
	(20.55)*	(20.55)*	(19.31)*	(19.31)*

The coefficients on **perenergy** and **permineral** are both significant in their respective regressions and have opposite signs. When a nation has a high quality resource level they seem to be exempt from the curse, as shown by the positive coefficient on **perenergy**. **resource** and, when used, **resourcegdp** are both insignificant. Using them in the regressions does not seem to change the results between each, again reiterated the results from Table 11 that there is not a results changing difference between **resource** and **resourcegdp**. Corruption is being held constant in each of these cases, so that the effect of the resource quality can be examined solely.

What is known is the Dutch Disease is a similar theory, which suggests that the reason countries with more natural resources have lower GDP's is because the high amount of resources devalues other goods within that country. This happens when the discovery of natural resources increases the value of that country's currency and makes products manufactured within that nation less competitive with the rest of the world. This causes imports to rise and exports to fall, thereby affecting the real exchange rate. To test this hypothesis, as an alternative to the idea of corruption as the main cause of low GDP's, a regression is performed that includes each country's real exchange rate as an exogenous variable. This variable is known as **realxrate** and the results are given in Table 15, again **lngdpcapita** is what is being regressed upon.

Table 15: Dutch Disease and Real Exchange Rate

Realxrate	-0.0005	-0.0004	-0.0005
	(-1.04)	(-1.03)	(-0.13)
perenergy		0.4494	
		(2.10)*	
resource	-0.0084	-0.0116	0.0022
	(-1.54)	(-1.93)*	(0.43)
cpiscore			0.1476
			(2.97)*
goveffeciveness			0.0139
			(3.34)*
literacy	0.0251	0.0257	0.0188
	(7.13)*	(7.10)*	(5.82)*
paved	0.0098	0.0062	0.0037
	(4.31)*	(2.61)*	(1.81)*
Roadper100	0.067	0.0639	0.0278
	(5.07)*	(5.11)*	(2.36)*
constant	5.9172	5.7344	5.5608
	(25.02)*	(20.13)*	(22.17)*

In each case the coefficient on real exchange rate is insignificant. The only regression which it seems to have an effect on **resource** is in the one that does not include the corruption variables or resource percentages. In this case the coefficient on resource is now insignificant, which may indicate that there is in fact a working effect of the Dutch Disease on a nation's GDP. Overall, however, **realxrate** does not appear to be as substantial a factor as corruption when explaining the effects of natural resources on a country's GDP, as it leaves most resource variables insignificant.

After each of these possible data changes are tested, the quality of resources seems to have the most results altering effect when added to the original regressions. One of the most valuable and covetable resources today is oil, as it largely affects the daily lives of most societies. It is possible that a nation in possession of large amounts of this asset may reap huge financial benefits despite the quality of their government or the level of corruption within the society and will, therefore, be further examined

. THE EFFECTS OF OIL AS A RESOURCE

Recent decades have bared witness to richer, more developed countries finding oil, which may lead to a skew in the data in favor of these economies. In the late 1970's the United States opened pipelines in Alaska and in the mid 1970's the North Sea came online. The United Kingdom, Denmark, Norway, the Netherlands, and Germany all have some stake in the North Sea oil findings. This would reiterate a positive relationship between national incomes and resources as both locations encompass developed, high GDP nations. In order to see if there may in fact be a difference between such resources, I have generated an additional variable **oilper1000,** which is each nation's oil production, measured in thousands of barrels per day. Table 16 gives this regression.

Table 16: Oil Production

Number of obs	131
F(6, 124)	147.80
Prob > F	0.0000
R-squared	0.8765
Root MSE	.38125

lngdpcapita	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
oilper1000	.0000822	.0000151	5.45	0.000	.0000524	.000112
cpiscore	.1423043	.0413363	3.44	0.001	.0604883	.2241203
goveffecti~s	.0141998	.0041827	3.39	0.001	.0059212	.0224785
literacy	.0161595	.0030642	5.27	0.000	.0100946	.0222244
RoadPer100	.0179733	.0079815	2.25	0.026	.0021756	.0337709
paved	.0047995	.002106	2.28	0.024	.0006312	.0089679
_cons	5.671184	.2445896	23.19	0.000	5.187072	6.155295

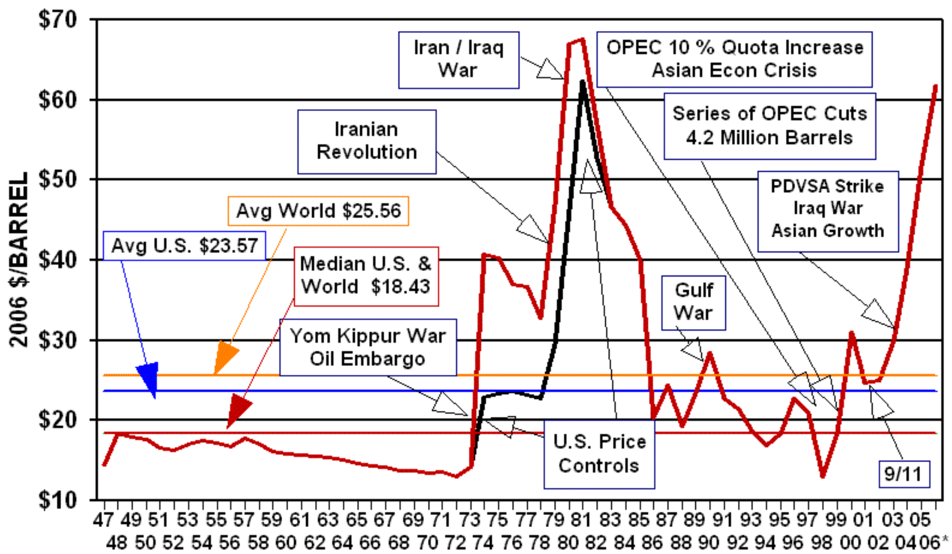
Again, even when accounting for corruption, **oilproduction** has a positive and significant coefficient. While this coefficient is very small, indicating that increasing a country's oil production by 1000 barrels per day will raise its per capita GDP by .008 percent holding all other variables constant, it is still opposite of what the resource curse suggests. This reiterates the idea that if a nation has a government in place which can implement effective policy, such as the United States, Iceland, and Norway, citizens can in fact be beneficiaries in the presence of natural resources.

In addition, those that have found the resource curse to be an actual phenomenon, such as Neumayer (2004); Bulte, Damania, and Deacon (2005); and Papyrakis and Gerlagh (2004), all use data from the early 1970's before the opening of Alaska and the North Sea. They also differ in their dependant variables which are growth in genuine income from 1970-1998, human development indices, and gross savings respectively. Each of them fails to measure the GDP per capita of each nation, which indicates the actual wealth being held by that economy during a current point in time. This allows us to see how each nation has used their resources, and if they have been able to implement advantageous policies in decades leading up to the current, which would provide them with higher GDP's.

There has also been a drastic increase in the world price of oil since the early 1970's. This may have had additional affects on the amount of rents that nations received as compared to the data used in the above analyses pre-mid 1970's. Figure 4 shows the average world pricing trend in 2006 dollars of crude oil from 1947 to 2006 marking the beginning of North Sea oil and Alaskan oil coming online by the spike in the late 1970's.

In addition, the price has drastically risen again since 2000, which is when the data for this analysis was collected.

Figure 4: Crude Oil Price Changes



(WTRG Economics)

CONCLUSIONS

The regression results indicate that the resource curse has the potential to not be a curse at all if resources are efficiently extracted and traded in a competitive market, absent of bad dealings or crooked behavior. Certain countries, Iceland and Norway, have proved this as well, by showing it is possible for benefits to be had from the discovery of what is essentially natural wealth. All that is required is a willingness to open one's market up to the economy, while ridding it of corruption.

What is not certain, however, is why resource rich countries are more prone to corruption to begin with, and what keeps it there. There are a couple explanations that I have formed to explain this. Political figures who actively engage in corruption create what becomes a vicious cycle. By exploiting rents that should be distributed or invested throughout the country, they are able to gain financial power, which it turn, allows them to control the system. This includes keeping the nation's economy from becoming transparent, an essential part of regulating corrupt practices. The people, who have no infrastructure or education system because their officials will not invest in them, are left with no way out; no fair system to engage in business and no chance at higher wages. Violence or upheaval may seem the only possible solution, which is in fact known to be positively correlated with natural resource levels; however, both only leave the country in even more financial distress. (Collier and Hoeffler)

It appears to be up to outside parties to aid in ending the corruption. The "Publish What You Pay" campaign, founded by several groups in 2002 including Transparency International and Global Witness had over 220 members in 2004 and mandates that payments made to governments on a country to country basis be published. Prime Minister Tony Blair, set up something similar in 2002 to aid in the creation of more transparency with the Extractive Industries Transparency Initiative. Both of which have been successful in bringing awareness to the issue, but pressure on countries where corruption is know to be prevalent, needs to continue to ensure that these leaders become accountable. (Herringshaw)

It is evident that corruption plays a substantial role in the way resources are allocated and as a result, the financial success of a nation. Being able to participate in the practices of commercial business without the burdens of bribery or bureaucratic injustice creates a system which can only enable economic growth. By forcing corrupt practices in the economy, inefficiency is rampant and no one is better off except those taking the bribes, but in the long run even they will be unable to prosper.

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